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ABSTRACT

A high speed computer is recommended for performing calculations and producing tables on current facility utilization. Increased efficiency and cost reduction are suggested results of this program. Facility usage is analyzed by establishing relationships between factors of space capacity and space occupancy. Four formulas determine room utilization by time period, total room utilization, building utilization by time period, and total building utilization. The program will analyze from 1 to 200 spaces, categorized by type of space, for each time period of the school day. The program is written in Fortran IV and requires a memory capacity of 15,000 words. Input data required are type description, room description, and room use. From three to eighteen output tables are possible. The program saved almost 8 hours time and a substantial amount of money. Three appendices show sample forms. (RH)

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FUAP--FACILITIES UTILIZATION ANALYSIS PROGRAM

by

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Introduction

The birth rate explosion of the 40's and 50's is being felt in every educational institution in the nation--from kindergarten to college. Many educational institutions are engaged in accelerated building and expansion programs and are still not able to meet current demands. Needless to say, it is essential that our nation's schools utilize every available facility to its fullest extent.

In an effort to increase facility utilization, many school districts employ trained consultants from universities, state departments of education, and private firms to study current use and suggest methods of gaining optimum utilization.

These facility utilization studies involve repetitive calculations which are time consuming and costly to perform using the ordinary desk calculator. In order to increase efficiency and reduce the cost of these studies, the FUAP program was developed. This program uses a high speed electronic computer to perform the calculations and produce tables showing statistics on current utilization.

The Analysis

One method of analyzing facility usage involves the establishment of relationships between the factors of space capacity and space occupancy. Space capacity is simply the number of pupil stations in a given room or educational area. Space occupancy is the number of pupils occupying the stations at any given time. Many school facilities are designed for special purpose uses, e.g., science laboratories,

vocational education classrooms, art rooms, music rooms, and gymnasiums. Consideration must be given to these special use rooms when analyzing utilization. In addition, each space must be analyzed in terms of standard or optimum capacity, as well as actual capacity, if the consultant is to have adequate data for making sound recommendations. The FUAP program is designed to employ the factors and considerations described above. Formulas used in the program are.[1]

I. Room Utilization by Time Period

$$U_a = P_2/S_a x\ D$$

$$U_s = P_2/S_s x\ D$$

II. Total Room Utilization

$$U_a = P_1/S_a \times W_p$$

$$U_s = P_1/S_s \times W_p$$

III. Building Utilization by Time Period

$$U_a = P_2/\ (S_a \times W_p)$$

$$U_s = P_2/\ (S_s \times W_p)$$

IV. Total Building Utilization

$$U_a = P_1/\ (S_a \times W_p)$$

$$U_s = P_1/\ (S_s \times W_p)$$

U_a = The percent of utilization based on the actual number of pupil stations in the room.

U_s = The percent of utilization based on recommended standard, or maximum, number of pupil stations the room will accommodate.

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[1]Edgar L. Morphet, "The Measurement And Interpretation of School Building Utilization," Contributions to Education, No. 264, (New York: Teachers College, Columbia University, 1927), p. 102.

If the standard number of stations is greater than maximum allowed, maximum is substituted for standard.

P_1 = Pupil periods per week calculated as follows: The sum of the number of pupils scheduled in a room all class periods of the day multiplied by the number of days per week the various classes meet.

P_2 = Pupil periods per week calculated as follows: The number of pupils scheduled in a room during a given class period of the day multiplied by the number of days per week the class meets.

S_a = Actual number of pupil stations in the room.

S_s = Standard number of pupil stations in the room calculated by dividing the total square foot area of the room by the standard number of square feet recommended for a pupil station. If the maximum number of pupil stations allowed per room is less than the standard, maximum is substituted for standard.

W_p = Periods in the week calculated by multiplying the number of time periods per day by the number of days per week school is in session.

D = Days per week a given class meets.

The Program

The FUAP program will analyze from 1 to 200 spaces categorized by type of space (1 to 15 type categories), for each time period of the school day (1 to 10 time periods) in a single pass. The program is written in Fortran IV and was originally compiled on an IBM 7044 computer. The program, exclusive of the compiler, requires approximately 15,000 words of memory capacity.

The program produces from 3 to 18 tables, depending upon the number of type categories established, showing percentages of utilization based on actual and standard (or maximum) number of pupil stations.

Input Data

Input data required to compute utilization is of three types; (1) type description, (2) room description, and (3) room use. Type

description is simply a description of the type of room represented by each type code used. For example, 01 = General Purpose, 02 = Science Labs, 03 = Physical Education, etc. Room description information includes the room number, type of room code, length and width in feet, area (required only if the shape of room is other than rectangular or square. If area is given, length and width are omitted), standard number of square feet recommended for each pupil station, the actual number of pupil stations in the room, and the maximum number of pupil stations (optional and necessary only if local policy established maximum pupil-teacher ratios which may be less than standard number of pupil stations). Room use data is the number of pupils meeting in each room each period of the day and the number of days per week that a particular class regularly meets. Multiple cards may be used to describe the day-met pattern of any given class.

In addition to the above, school header information is required. The header information is simply the district name, the school name, and the standard number of time periods in the regular school day. Input data forms are presented in appendix A.

Output Tables

The number of output tables produced depends upon the number of type categories used and will range from a minimum of three to a maximum of eighteen. Examples of each table are shown in the appendix B.

Table 1 presents by room the area in square feet, the number of square feet per actual pupil station, the recommended number of square

feet per pupil station, difference between actual and standard, the maximum number of pupil stations permitted, and the standard number of pupil stations the room will accommodate, and the difference between maximum and standard number of pupil stations.

Table 2 presents the percent of utilization (based on the number of actual pupil stations) each period in the day for each room in the building. The total percent of utilization is shown for each room, for each period of the day, and for the entire building.

Table 3 is similar to table 2 with the exception that utilization is based upon the standard (or maximum) number of pupil stations rather than the actual number of pupil stations.

Tables 4 through 18 present the percentages of utilization of each room summarized by type of room. Two tables are produced for each type category. The table format is identical to tables two and three described above.

Cost Savings

Trial runs of the program, using both hypothetical and actual data, were made to establish time and cost data. The results of the computer runs were compared to conventional hand methods of table compilation. The comparisons showed a reduction of approximately 7 hrs. and 58 minutes in total time required to prepare the tables. Total cost savings were estimated at $75.00-$100.00. In addition to the savings gained through the reduction of time required to prepare the analyses, much more comprehensive and comparable data were provided by the use of the FUAP program.

APPENDIX A.

TYPE CODE DESCRIPTION FORM

Type Code	Type Description

APPENDIX B.

ROOM INFORMATION FORM

District Name: _____ School Name: _____ Number Periods Per Day: _____

Room #	Type Code	Length In Feet	Width In Feet	Area	Std. Sq. Ft. Per Pupil	Actual Pupil Station	Max. Pupil Station	Room #	Type Code	Length In Feet	Width In Feet	Area	Std. Sq. Ft. Per Pupil	Actual Pupil Station	Max. Pupil Station

ROOM USE FORM

Room Number	Period 1		Period 2		Period 3		Period 4		Period 5		Period 6		Period 7		Period 8		Period 9		Period 10	
	Days	Pupils	Days	Pupils	Days	Pupils	Days	Pupils	Days	Pupils	Days	Pupils	Days	Pupils	Days	Pupils	Days	Pupils	Days	Pupils

APPENDIX C

APPENDIX D
TYPE DESCRIPTION CARD

TYPE CODE

DESCRIPTION OF TYPE

DESCRIPTION OF TYPE

MID-CONTINENT 5081

APPENDIX E

DISTRICT NAME

SCHOOL NAME

FIELDS

MID-CONTINENT 5081

APPENDIX F
ROOM HEADER CARD

Room Number

TYPE

LENGTH

WIDTH

AREA

STANDARD SQ. FT. /PUPIL STA.

ACTUAL PUPIL STA.

MAXIMUM PUPIL STA.

MID-CONTINENT 5081

Appendix G

Room Number | Bd 1 Pupils | Bd 2 Pupils | Bd 3 Pupils | Bd 4 Pupils | Bd 5 Pupils | Bd 6 Pupils | Bd 7 Pupils | Bd 8 Pupils | Bd 9 Pupils | Bd 10 Pupils | DAYS

Room Use Card

MID-CONTINENT 6081

ANALYSIS OF DISTRICT DUBUQUE COMMUNITY SCHOOL SCHOOL JEFFERSON JUNIOR HIGH

TABLE 1

ROOM	TP	AREA	ACTUAL SQ. FT./STATION	STANDARD SQ. FT./STATION	DIFFERENCE	MAXIMUM NO. STATIONS	STANDARD NO. STATIONS	DIFFERENCE
C001	8	1290.	46.1	35.0	11.1	-0.	37.	-36.9
C037	7	1628.	67.8	100.0	-32.2	-0.	16.	-16.3
C048	10	667.	51.3	25.0	26.3	-0.	27.	-26.7
C071	5	638.	14.2	20.0	-5.8	-0.	32.	-31.9
C101	3	1290.	35.8	35.0	0.8	-0.	37.	-36.9
0110	11	300.	15.0	25.0	-10.0	-0.	12.	-12.0
0112	1	550.	15.3	25.0	-9.7	-0.	22.	-22.0
0113	1	550.	15.3	25.0	-9.7	-0.	22.	-22.0
0116	1	572.	16.8	25.0	-8.2	-0.	23.	-22.9
0125	1	594.	17.5	25.0	-7.5	-0.	24.	-23.8
0126	1	616.	18.1	25.0	-6.9	-0.	25.	-24.7
0201	4	1290.	46.1	40.0	6.1	-0.	32.	-32.3
0209	1	550.	15.3	25.0	-9.7	-0.	22.	-22.0
0210	1	550.	15.3	25.0	-9.7	-0.	22.	-22.0
0212	1	572.	16.8	25.0	-8.2	-0.	23.	-22.9
0216	4	1034.	43.1	40.0	3.1	-0.	26.	-25.9
0221	2	1320.	33.0	35.0	-2.0	-0.	38.	-37.8
0222	1	572.	16.8	35.0	-18.2	-0.	16.	-16.4
0223	1	660.	18.3	25.0	-6.7	-0.	26.	-26.4
0016	12	4992.	128.0	150.0	-22.0	-0.	33.	-33.3
MEAN DIFFERENCES					-6.0			-25.8

APPENDIX H

TABLE 2 UTILIZATION BASED ON ACTUAL

ROOM	TYPE	PER 1	PER 2	PER 3	PER 4	PER 5	PER 6	TOTAL
C001	8	78.6	0.0	14.3	60.8	85.8	0.0	39.9
C037	7	87.5	50.0	75.0	66.7	58.4	54.2	65.3
0048	10	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0071	5	49.4	64.5	73.4	71.2	56.0	42.7	59.5
C101	3	50.0	83.9	0.0	50.0	50.0	75.6	51.6
0110	11	29.0	44.0	52.0	62.0	0.0	11.0	33.0
0112	1	38.9	97.3	44.5	44.5	38.9	77.8	57.0
0113	1	41.7	86.2	83.4	80.6	97.3	69.5	76.4
0116	1	55.9	91.2	91.2	97.1	88.3	88.3	85.3
0125	1	82.4	47.1	41.2	41.2	0.0	47.1	43.2
0126	1	97.1	47.1	76.5	0.0	61.8	85.3	61.3
C201	4	42.9	67.9	53.6	75.0	39.3	67.9	57.8
0209	1	72.3	91.7	80.6	77.8	77.8	88.9	81.5
0210	1	97.3	63.9	77.8	77.8	86.2	86.2	81.5
0212	1	85.3	73.6	88.3	41.2	82.4	94.2	77.5
0216	4	70.9	0.0	75.0	83.4	79.2	79.2	64.6
0221	2	77.5	57.5	50.0	75.0	85.0	65.0	68.4
0222	1	67.7	88.3	94.2	91.2	85.3	97.1	87.3
0223	1	77.8	66.7	77.8	97.3	69.5	86.2	79.2
001G	12	82.1	80.0	82.1	71.8	89.3	75.9	80.2
TOTAL		68.7	66.5	66.1	67.3	67.1	70.4	67.7

Appendix I

TABLE 3 UTILIZATION BASED ON STANDARD OR MAXIMUM

ROOM	TYPE	PER 1	PER 2	PER 3	PER 4	PER 5	PER 6	TOTAL
C001	8	59.7	0.0	10.9	46.1	65.1	0.0	30.3
0037	7	128.6	73.5	110.3	98.0	85.8	79.7	96.0
0048	10	48.7	48.7	48.7	48.7	48.7	48.7	48.7
C071	5	69.5	90.8	103.3	100.2	78.9	60.1	83.8
0101	3	48.8	81.9	0.0	48.8	48.8	73.7	50.4
0110	11	48.2	73.1	86.4	103.0	C.0	18.3	54.8
0112	1	63.5	158.8	72.6	72.6	63.5	127.0	93.0
0113	1	68.1	140.6	136.1	131.6	158.8	113.4	124.8
0116	1	82.9	135.2	135.2	144.0	130.9	130.9	126.5
0125	1	117.6	67.2	58.8	58.8	0.0	67.2	61.6
0126	1	133.7	64.9	105.4	0.0	85.1	117.5	84.4
0201	4	37.2	58.9	46.5	65.1	34.1	58.9	50.1
0209	1	118.0	149.7	131.6	127.0	127.0	145.2	133.1
0210	1	158.8	104.4	127.0	127.0	140.6	140.6	133.1
0212	1	126.5	109.1	130.9	61.1	122.2	139.6	114.9
C216	4	65.7	0.0	69.5	77.3	73.4	73.4	59.9
0221	2	82.1	61.0	53.0	79.5	90.1	68.9	72.4
C222	1	140.4	183.1	195.3	189.2	177.0	201.4	181.0
0223	1	105.9	90.8	105.9	132.4	94.6	117.3	107.8
C01G	12	96.1	93.7	96.1	84.1	104.5	88.9	93.9
TOTAL		86.2	83.5	82.9	84.5	84.2	88.3	84.9

APPENDIX J

TABLE 4 UTILIZATION ROOM TYPE 1 GENERAL PURPOSE BASED ON ACTUAL

ROOM	PER 1	PER 2	PER 3	PER 4	PER 5	PER 6	TOTAL
0112	38.9	97.3	44.5	44.5	38.9	77.8	57.0
C113	41.7	86.2	83.4	80.6	97.3	69.5	76.4
0116	55.9	91.2	91.2	97.1	88.3	88.3	85.3
0125	82.4	47.1	41.2	41.2	0.0	47.1	43.2
0126	97.1	47.1	76.5	0.0	61.8	85.3	61.3
0209	72.3	91.7	80.6	77.8	77.8	88.9	81.5
0210	97.3	63.9	77.8	77.8	86.2	86.2	81.5
0212	85.3	73.6	88.3	41.2	82.4	94.2	77.5
C222	67.7	88.3	94.2	91.2	85.3	97.1	87.3
0223	77.8	66.7	77.8	97.3	69.5	86.2	79.2
TOTAL	71.5	75.5	75.5	65.2	68.9	82.0	73.1

APPENDIX K